



Device for Monitoring and Controlling SMA Inverters in
Decentralised Large-Scale PV Plants

SMA CLUSTER CONTROLLER

Installation Manual

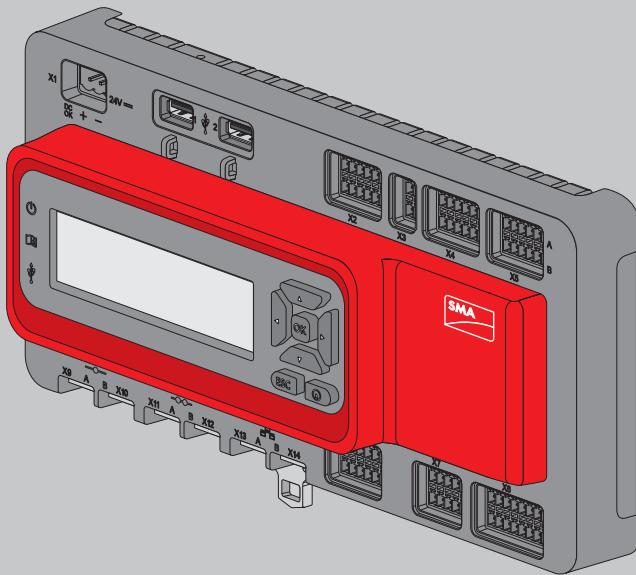


Table of Contents

1	Information on this Document	6
2	Safety	8
2.1	Intended Use	8
2.2	Qualifications of Skilled Persons	10
2.3	Safety Precautions	10
3	Scope of Delivery	11
4	Product Description	12
4.1	Cluster Controller	12
4.2	Type Label	16
4.3	LEDs	17
4.4	Display	18
4.5	Button Field	20
4.6	System Requirements of the Computer	20
5	Assembly	21
5.1	Selecting the Mounting Location	21
5.2	Mounting the Cluster Controller	23
6	Connection	24
6.1	Overview of the Connection Area	24
6.2	Functions of the Terminals and Terminal Blocks	25
6.3	Cable Requirements	27
6.4	Performing Pin Coding	29
6.5	Preparing Connection Cables for Connection to a Multipole Plug	30
6.6	Connecting the Cluster Controller to a Speedwire Network	32
6.7	Connecting the Cluster Controller to a Local Area Network (LAN)	34
6.8	Setting Up a Modbus Data Connection	35
6.9	Connecting USB Data Carriers to the Cluster Controller	35

6.10 Connecting Sensors to the Cluster Controller	37
6.10.1 Connecting the Irradiation Sensor	37
6.10.2 Connecting the Temperature Sensor	39
6.10.3 Connecting Additional Sensors	41
6.11 Connections for Grid Management.....	45
6.11.1 Options for Implementing the Network Operator Setpoints	45
6.11.2 Digital Signal Setpoint	46
6.11.2.1 Connecting the Signal Source to the Digital Input for the Active Power Limitation	46
6.11.2.2 Connecting the Signal Source to the Digital Input for the Reactive Power Setpoint.....	47
6.11.3 Analogue Signal Setpoint	49
6.11.3.1 Connecting the Signal Source to the Analogue Input for the Active Power Limitation	49
6.11.3.2 Connecting the Signal Source to the Analogue Input for the Reactive Power Setpoint.....	51
6.11.4 Setpoint via Modbus Client	52
6.11.5 Connecting the Remote Terminal for Feedback of Network Operator Setpoints	52
6.12 Using Fault Indication Relays.....	57
6.13 Connecting the Cluster Controller to the Voltage Supply	58
6.14 Checking the Connections via the Display.....	61
6.15 Performing Configuration for a Static Local Network (LAN)	64
7 Troubleshooting	65
7.1 LED States	65
7.1.1 Operation LEDs	65
7.1.2 LEDs of the Network Connections	69
7.2 Faults in the Cluster Controller or the Connected Devices.....	70
7.3 Resetting the Cluster Controller	75
8 Decommissioning	76
8.1 Disassembling the Cluster Controller.....	76
8.2 Disposing of the Cluster Controller	76

9	Technical Data	77
10	Accessories	81
11	Contact	82

1 Information on this Document

Validity

This document is applicable for the device type "CLCON-10.GR1" from hardware version A1 and from firmware version 1.0.

Target Group

This document is intended for skilled persons. Only qualified personnel are allowed to perform the tasks described in this manual (see Section 2.2 "Qualifications of Skilled Persons", page 10).

Symbols

Symbol	Explanation
	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
	Indicates a hazardous situation which, if not avoided, could result in death or serious injury
	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
	Indicates a situation which, if not avoided, could result in property damage
	Information that is important for a specific topic or goal, but is not safety-relevant
<input type="checkbox"/>	Indicates an essential requirement for achieving a specific goal
<input checked="" type="checkbox"/>	Desired result
	A problem that might occur

Typographies

Typography	Use	Example
bold	<ul style="list-style-type: none"> Display messages Elements of a user interface Connections Elements to be selected Elements to be entered 	<ul style="list-style-type: none"> The value can be read from the Energy field. Select Settings. Enter the value 10 in the Minutes field.
>	<ul style="list-style-type: none"> Connects several elements that are to be selected 	<ul style="list-style-type: none"> Select Settings > Date.
[Button/Key]	<ul style="list-style-type: none"> Button or key to be selected or pressed 	<ul style="list-style-type: none"> Select [Next].

Nomenclature

Complete designation	Designation in this document
Large-scale PV plant	Plant
PV inverter	Inverter
SMA Cluster Controller	Cluster Controller

Abbreviations

Abbreviation	Designation	Explanation
CO	Change Over	Relay change-over contact
DHCP	Dynamic Host Configuration Protocol	Protocol for the dynamic assignment of IP configurations
FTP	File Transfer Protocol	Network protocol for data transmission
LED	Light-Emitting Diode	-
MSL	Mean Sea Level	-
NC	Normally Closed	Rest contact of the relay
NO	Normally Open	Operating contact of the relay
PV	Photovoltaics	-
TCP	Transmission Control Protocol	Transport protocol for packet-switching in connection-oriented networks
USB	Universal Serial Bus	Serial bus system

2 Safety

2.1 Intended Use

The Cluster Controller is a device for monitoring and controlling up to 75 SMA inverters in decentralised large-scale PV plants. For this purpose, the Cluster Controller performs the following essential tasks:

- Reading out, provision and administration of plant data
- Configuring device parameters
- Sending e-mail alerts in the event of critical plant statuses
- Implementation and feedback of network operator setpoints for active power limitation and reactive power under grid management
- Sending the plant data to an FTP server and/or the Sunny Portal Internet portal
- Performing updates for the Cluster Controller and the inverters

The Cluster Controller is an ITE Class A device according to EN 55022 and is designed for industrial use.

The Cluster Controller is suitable for indoor use only.

The Cluster Controller must only be used with supported devices.

For safety reasons, it is not permitted to modify the product or install components that are not explicitly recommended or distributed by SMA Solar Technology AG for this product.

The enclosed documentation is an integral part of this product:

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

Only use the Cluster Controller in accordance with the information provided in the enclosed documentation. Any other use may result in personal injury or property damage.

Supported Products

SMA products

The Cluster Controller can establish a connection to and display data on the following SMA products that are equipped with Speedwire communication:

Inverters:

- All inverters with integrated or retrofitted Speedwire/Webconnect interface

Information on whether an inverter has an integrated Speedwire/Webconnect interface or can be retrofitted with a Speedwire/Webconnect interface can be found in the download area of the respective inverter at www.SMA-Solar.com.

Additional products:

- Sunny Portal

Products from other manufacturers

Sensors:

- Irradiation sensors that can output a current signal in the range from 0 mA to 20 mA
- Temperature sensors with a PT100 measuring shunt or a PT1000 measuring shunt
- Additional sensors that can output a current signal in the range from 0 mA to 20 mA or a voltage signal in the range from -10 V to +10 V

Digital and analogue signal sources:

- Signal sources with digital relay contacts
- Signal sources that provide digital output signals
- Signal sources that can output current signals in the range from 0 mA to 20 mA
- Signal sources that can process current signals in the range from 0 mA to 20 mA
- Signal sources that can output voltage signals in the range from -10 V to +10 V

Routers and network switches:

- Routers and network switches for fast Ethernet with a data transfer speed of at least 100 Mbit/s

Top-hat rail power supply units:

Along with the top-hat rail power supply units offered as an accessory (see Section 10), the Cluster Controller supports top-hat rail power supply units with the following properties:

- Maximum output current including short circuit: 8 A
- Maximum apparent output power: 100 VA
- DC output voltage: 24 V
- Nominal current: minimum 1.8 A

2.2 Qualifications of Skilled Persons

The work described in this document must only be performed by skilled persons. Skilled persons must have the following qualifications:

- Training in the installation and commissioning of electrical devices
- Training in how to deal with the dangers and risks involved in installing and operating electrical devices and plants
- Vocational training in the installation and configuration of IT systems
- Knowledge of how an inverter works and is operated
- Knowledge of all applicable standards and directives
- Knowledge of and compliance with this document and all the safety precautions

2.3 Safety Precautions

Electric Shock

If the enclosure of the Cluster Controller is not earthed, there is a danger of electric shock.

- Earth the enclosure of the Cluster Controller (for information on connecting the protective conductor, see Section 6.13).

Damage to the Devices and Cables

Oversupply (e.g. due to a flash of lightning) can cause damage to devices and cables.

- Ensure that the Cluster Controller is integrated in the existing oversupply protection.

The Cluster Controller is not splashwater-protected (degree of protection: IP20). Consequently, it is possible that moisture may penetrate the device.

- Only use the Cluster Controller in a dry, indoor environment.

3 Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your specialist dealer if the delivery is incomplete or damaged.

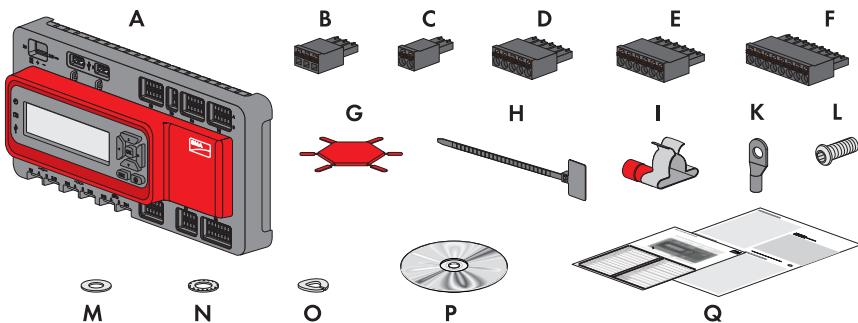


Figure 1: Components included in scope of delivery

Item	Quantity	Designation
A	1	Cluster Controller
B	1	Three-pole plug
C	1	Two-pole plug*
D	2	Five-pole plug
E	8	Six-pole plug**
F	2	Eight-pole plug
G	2	Coding element
H	20	Cable ties with caption field
I	8	Shield clamp with ring terminal lug
K	1	Ring terminal lug
L	1	Fastening screw
M	2	Washer
N	1	Tooth lock washer
O	1	Split lock washer
P	1	CD with installation manual and user manuals
Q	1	Quick reference guide for commissioning and supplementary sheet for noting connected devices

* Reserved for future applications. Keep the plug in a safe place.

** Two of the eight plugs are reserved for future applications. Keep the two plugs in a safe place.

4 Product Description

4.1 Cluster Controller

The Cluster Controller is a device for monitoring and controlling up to 75 SMA inverters in decentralised large-scale PV plants. For this purpose, the Cluster Controller performs the following essential tasks:

- Reading out, provision and administration of plant data
- Configuring device parameters
- Implementation and feedback of network operator setpoints for active power limitation and reactive power operation under grid management
- Sending e-mail alerts in the event of critical plant statuses
- Sending the plant data to an FTP server and/or the Sunny Portal Internet portal
- Performing updates for the Cluster Controller and the inverters

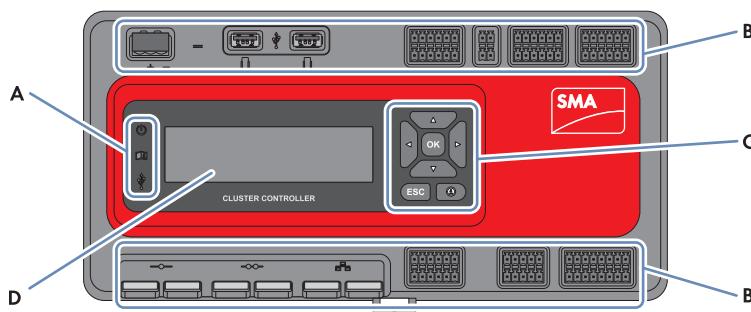


Figure 2: Design of the Cluster Controller

Item	Designation
A	LEDs
B	Connection areas
C	Button field
D	Display

Reading out, Provision and Administration of Plant Data

The Cluster Controller is the central communication unit for the plant and continuously reads out the data of the devices in the plant (e.g. inverters, sensors). The Cluster Controller then makes this plant data available via the display, user interface and Modbus®* data interface. In addition, the plant data can be displayed, evaluated and managed using Sunny Portal (see the Cluster Controller user manual and the user manual of the Cluster Controller in Sunny Portal).

Configuring Device Parameters

You can configure specific parameters of individual devices or entire device classes via the user interface of the Cluster Controller. For this purpose, you must be logged into the **Installer** user group on the Cluster Controller. The device parameters that can be configured, if any, depend on the device and the rights of the user group. You may only change grid-sensitive device parameters (SMA Grid Guard parameters) with the approval of the network operator and using your personal SMA Grid Guard code (see the Cluster Controller user manual).

Sending E-Mail Alerts in the Event of Critical Plant Statuses

You have the option of receiving prompt information on critical plant statuses via e-mail (see the Cluster Controller user manual). The Cluster Controller automatically sends a notification if alert-related events occur in the plant.

Implementation and Feedback of Network Operator Setpoints for Active Power Limitation and Reactive Power Operation under Grid Management

With the Cluster Controller, you can implement different network operator setpoints for the active power limitation and the reactive power operation of your plant under grid management. Your network operator transmits the setpoints directly to the Cluster Controller, either in the form of digital or analogue signals (e.g. to a ripple control receiver that is connected to the Cluster Controller) or via the Modbus client. In agreement with your network operator, you can use the user interface of the Cluster Controller to configure which setpoints of the Cluster Controller are to be transmitted to the connected inverters depending on the respective signal. In addition, you have the option of using a digital response contact or an analogue current output signal to inform the network operator of the setpoints (if any) for the active power limitation and the reactive power operation that are currently being transmitted to the plant.

Sending the Plant Data to an FTP Server and/or the Sunny Portal Internet Portal

The Cluster Controller can automatically send the plant data that has been read out to an arbitrary FTP server and/or the Sunny Portal Internet portal via the Internet. The Cluster Controller establishes the connection to the FTP server and/or the Sunny Portal e.g. via a router.

* Modbus® is a registered trademark of Schneider Electric and is licensed through Modbus Organization, Inc.

Performing Updates for the Cluster Controller and the Inverters

You have the option of performing updates for the Cluster Controller and the inverters in the plant (see the Cluster Controller user manual). You can perform the updates automatically or manually. The update source can be the SMA update portal or a USB data carrier with update files downloaded from the Internet. Alternatively, you can also upload the update files directly from the computer via the user interface of the Cluster Controller.

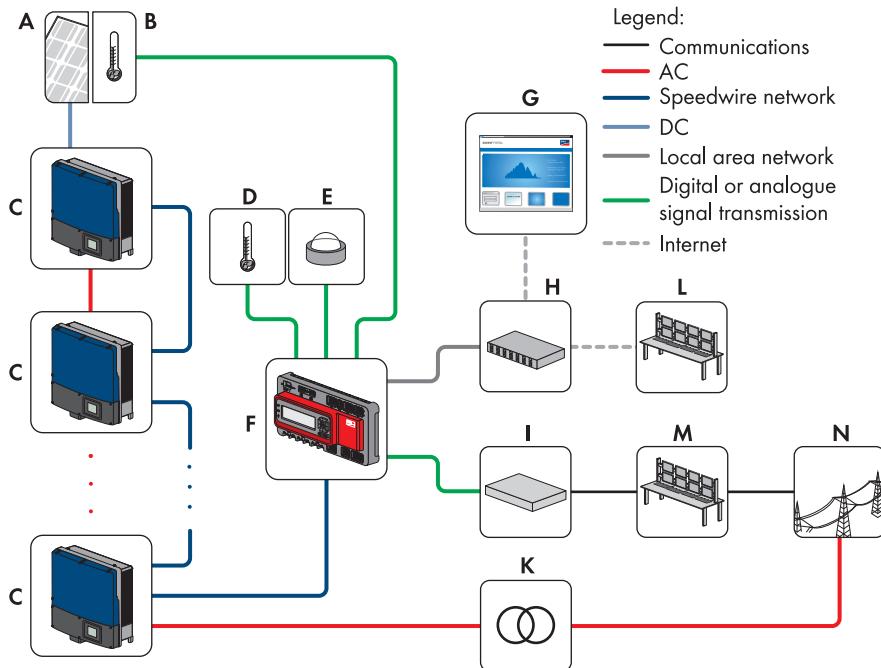


Figure 3: Decentralised large-scale PV plant with Cluster Controller (example)

Item	Designation
A	PV modules
B	Module temperature sensor
C	Inverters
D	Outside temperature sensor
E	Irradiation sensor
F	Cluster Controller
G	Sunny Portal
H	Router
I	Ripple control receiver or remote terminal unit
K	Grid station
L	Control room
M	Grid control room
N	Electricity grid

4.2 Type Label

The type label provides unique identification of the Cluster Controller. The type label can be found on the back of the enclosure.

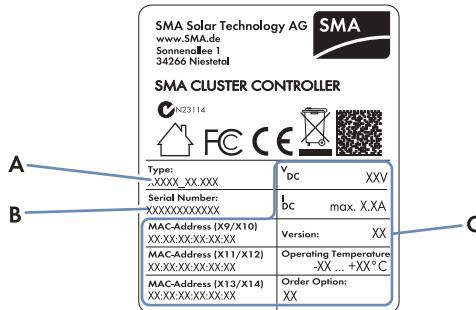


Figure 4: Layout of the type label

Item	Explanation
A	Device type
B	Serial number
C	Device-specific characteristics

You require the information on the type label to use the Cluster Controller safely and for customer support from the SMA Service Line. The type label must be permanently attached to the Cluster Controller.

Symbols on the Type Label

Symbol	Designation	Explanation
 N23114	C-Tick	The product complies with the requirements of the applicable Australian EMC standards.
	Indoor	The device is only suitable for indoor mounting.
	FCC marking	The product complies with the requirements of the applicable FCC standards.
	CE marking	The product complies with the requirements of the applicable EC directives.
	WEEE designation	Do not dispose of the product together with the household waste but only in accordance with the locally applicable regulations for disposal of electronic waste.
	Data matrix code	2D code for device-specific characteristics

4.3 LEDs

Operation LEDs

LED	Designation	Explanation
	Power LED	Displays whether the Cluster Controller is starting or is in operation (for a description of the LED statuses, see Section 7.1.1)
	Status LED	Displays the status of the Cluster Controller and the connected devices as well as the communication status of the plant and the status of the grid management (for a description of the LED statuses, see Section 7.1.1)
	Data carrier status LED	Displays the status of the connected USB data carrier (for a description of the LED statuses, see Section 7.1.1)

LEDs of the Network Connections

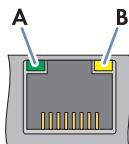


Figure 5: LEDs of the network connections

Item	Designation	Colour	Explanation
A	Link/activity LED	Green	Displays the status and the activity of the network connection (for a description of the LED statuses, see Section 7.1.2)
B	Speed LED	Yellow	Displays the speed of the network connection (for a description of the LED statuses, see Section 7.1.2)

4.4 Display

The display shows information on the Cluster Controller and the connected devices as well as the plant status and the plant configuration. The display contrast can be configured (see the Cluster Controller user manual). The display languages are German and English. The display language is changed via the user interface of the Cluster Controller (see the Cluster Controller user manual).

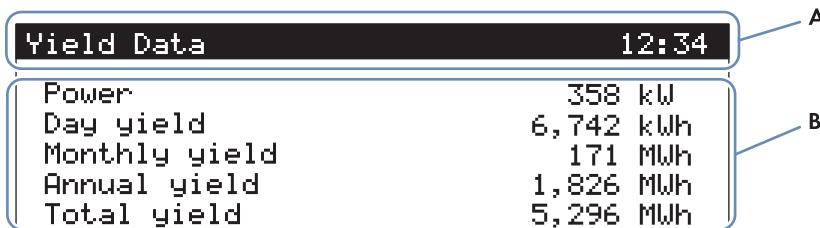


Figure 6: Display of the Cluster Controller (example)

Item	Designation	Explanation
A	Title line	Displays the title of the display view The display time is always displayed.
B	Data lines	Displays text and numeric values The numeric values for measurement or yield data are displayed with units.

Overview of the Display Views

Display view	Explanation
Start view	Displays when the Cluster Controller starts up and includes the current firmware version of the Cluster Controller
Plant overview	Displays the plant status, the current daily yield, the plant power and the current setpoints for active power and reactive power If no button on the button field is pressed within five minutes, the Cluster Controller switches to the Plant overview display view.
Yield data	Displays the yield data of the plant
Plant status	Displays the current plant status The number of inverters detected by the Cluster Controller and the status of the inverters is displayed here
Cluster Controller	Displays the status and device information of the Cluster Controller When a USB data carrier is inserted into USB terminal 1, information on the current memory usage of the USB data carrier will be displayed.
Sunny Portal settings	Displays the configured upload frequency and the date of the last successful data upload to Sunny Portal
Analogue inputs	Displays the analogue inputs with the current level value and unit
Digital inputs	Displays the digital inputs in binary form The digital inputs are summarised in two groups here.
Meteorology	Displays the measured values of the connected irradiation sensor and the connected temperature sensors
Active power limitation	Displays the current setpoint for active power limitation with the data of the last change to the configuration
Reactive power setpoint	Displays the current reactive power setpoint and the date of the last change to the configuration
Grid management	Displays the selected setpoint type and the signal sources for the grid management via the user interface of the Cluster Controller
External communication	Displays the settings for the local area network (LAN)
Speedwire	Displays the settings in the Speedwire network
Modbus settings	Displays the Modbus settings with the activated network protocols and the corresponding network ports
Settings	Enables the display contrast to be changed and the Cluster Controller to be partially or fully reset (see Section 7.3)

4.5 Button Field

Designation	Explanation
Any button	Activates the display illumination
Arrow buttons (◀, ▶, ▲, ▼)	Change the display views and select specific display lines
[OK]	Confirms the selected action
[ESC]	Cancels the selected action
(i)	Opens the Plant status display view

4.6 System Requirements of the Computer

Supported Internet browsers:

- Microsoft Internet Explorer from version 8
- Mozilla Firefox from version 3.6

Recommended screen resolution:

- Minimum 1,024 pixels x 768 pixels

5 Assembly

5.1 Selecting the Mounting Location

Requirements for the mounting location:

NOTICE

Radio interference in living areas possible due to the Cluster Controller

The Cluster Controller is a device of ITE class A (EN 55022) and can cause radio interference in living areas.

- Take suitable measures for shielding radio waves when used in the vicinity of living areas.

- The mounting location must be indoors.
- The ambient conditions at the mounting location must be suitable for the operation of the Cluster Controller (see Section 9 "Technical Data", page 77).
- The mounting location must be protected against dust, moisture and corrosive substances.

Observe the maximum cable length:

- Observe the respective maximum cable length of 100 m between two nodes in the Speedwire network and in the local area network (LAN).
- When connecting a digital or analogue signal source (e.g. remote terminal unit, ripple control receiver), observe the maximum cable length of 30 m from the Cluster Controller to the signal source.
- When connecting a temperature sensor in a four-conductor connection, observe the maximum cable length of 20 m from the Cluster Controller to the temperature sensor.
- When connecting a temperature sensor in a two-conductor connection, observe the maximum cable length of 2.5 m from the Cluster Controller to the temperature sensor.

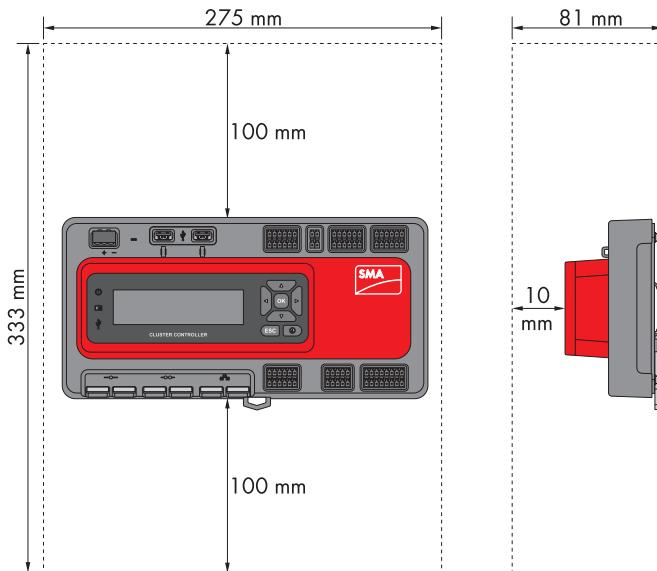
Observe minimum clearances:

Figure 7: Minimum clearances

- Maintain the minimum clearance to walls and other devices or objects.

Observe permitted mounting position:

- Mount the Cluster Controller in such way, that the ventilation slots face the top and the bottom. This ensures adequate ventilation and avoids overheating of the Cluster Controller.

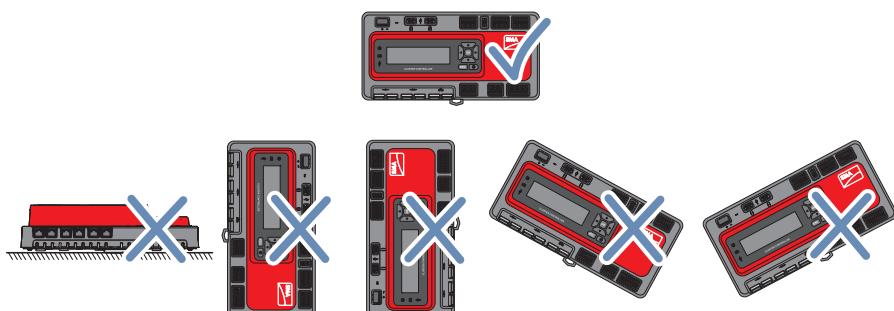


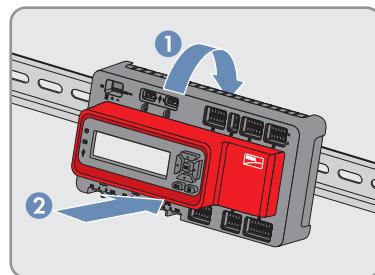
Figure 8: Permitted and prohibited mounting positions

5.2 Mounting the Cluster Controller

Requirements:

- A top-hat rail must be available.
- The top-hat rail must be 35 mm wide.
- To mount the Cluster Controller, the top-hat rail must be at least 26 cm long.
- To mount the top-hat rail power supply unit, the top-hat rail must be correspondingly longer.
- The top-hat rail must be securely mounted on the wall or in the switch cabinet.

- Use the rear-side upper retainers to hook the Cluster Controller into upper edge of the top-hat rail and press down in the direction of the top-hat rail. This will hook the spring-mounted top-hat rail locking mechanism of the Cluster Controller onto the lower edge of the top-hat rail.
- The top-hat rail locking mechanism audibly snaps into place.



6 Connection

6.1 Overview of the Connection Area

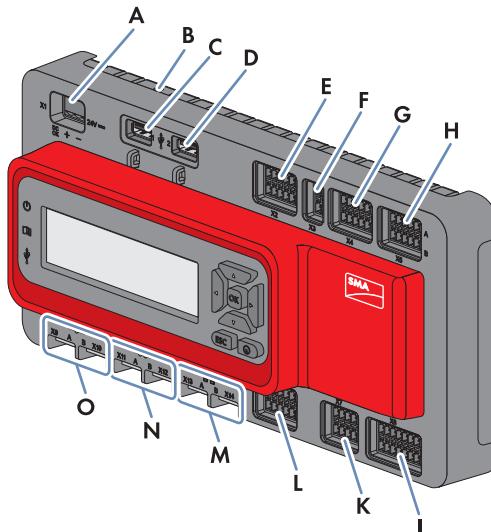


Figure 9: Overview of the connection area

Item	Quantity	Designation	Explanation
A	1	X1	Terminal for the voltage supply
B	1	-	Terminal for the earthing
C	1	1	USB terminal for exporting plant data
D	1	2	USB terminal for updates
E	1	X2	Digital outputs (for description of functions, see Section 6.2)
F	1	X3	Reserved for future applications
G	1	X4	Digital inputs (for description of functions, see Section 6.2)
H	1	X5	Digital inputs (for description of functions, see Section 6.2)
I	1	X8	Analogue inputs (for description of functions, see Section 6.2)
K	1	X7	Terminals for the temperature sensors (for description of functions, see Section 6.2)

Item	Quantity	Designation	Explanation
L	1	X6	Analogue outputs (for description of functions, see Section 6.2)
M	2	X13, X14	Network terminals for local area network (LAN)
N	2	X11, X12	Reserved for future applications
O	2	X9, X10	Network terminal of the inverter (Speedwire)

6.2 Functions of the Terminals and Terminal Blocks

The digital and analogue terminals of the Cluster Controller are divided into terminal blocks. A terminal block is a group of pins. Each respective pin group forms one of the digital or analogue inputs or outputs. On the enclosure, the upper row of pins is marked with **A** and the lower row of pins is marked with **B**. The pins are counted from left to right.

The distribution of the terminals into terminal blocks and the functions of the terminal blocks are described in the following table.

Connection	Terminal block	Pin	Function
X1	–	1 ... 3	Voltage supply
X2	Digital output 1 (DO1) Relay A	A1 ... A3	Fault indication relay for the status Fault
	Digital output 2 (DO2) Relay B	A4 ... A6	Fault indication relay for the status Warning or Fault
	Digital output 3 (DO3) Relay C	B1 ... B3	Response contact for the current active power limitation under grid management
X3	–	–	Reserved for future applications
X4	Digital input 1 (DI1)	A1 ... A3	Signal 1 of 4 for the active power limitation under grid management
	Digital input 2 (DI2)	A4 ... A6	Signal 2 of 4 for the active power limitation under grid management
	Digital input 3 (DI3)	B1 ... B3	Signal 3 of 4 for the active power limitation under grid management
	Digital input 4 (DI4)	B4 ... B6	Signal 4 of 4 for the active power limitation under grid management

Connection	Terminal block	Pin	Function
X5	Digital input 5 (DI5)	A1 ... A3	Signal 1 of 4 for the reactive power setpoint under grid management
	Digital input 6 (DI6)	A4 ... A6	Signal 2 of 4 for the reactive power setpoint under grid management
	Digital input 7 (DI7)	B1 ... B3	Signal 3 of 4 for the reactive power setpoint under grid management
	Digital input 8 (DI8)	B4 ... B6	Signal 4 of 4 for the reactive power setpoint under grid management
X6	Analogue current output 1 (AO1)	A1... A3	Analogue current output for the feedback of the current active power limitation under grid management
	Analogue current output 2 (AO2)	A4 ... A6	Analogue current output for the feedback of the current reactive power setpoint under grid management
X7	Temperature input 1	A1 ... A5	Analogue input for the connection of an external temperature sensor
	Temperature input 2	B1 ... B5	Analogue input for the connection of a module temperature sensor
X8	Analogue current input 1 (AI1)	A1 ... A4	Analogue current input for the connection of an irradiation sensor or a different sensor
	Analogue current input 2 (AI2)	A5 ... A8	Analogue current input for the active power setpoint under grid management or for the connection of a sensor
	Analogue current input 3 (AI3)	B1 ... B4	Analogue current input for the reactive power setpoint under grid management or for the connection of a sensor
	Analogue voltage input 4 (AI4)	B5 ... B8	Analogue voltage input for the connection of a sensor
X9, X10	–	1 ... 8	Network terminal of the inverter (Speedwire)
X11, X12	–	–	Reserved for future applications
X13, X14	–	1 ... 8	Network terminals for local area network (LAN)

6.3 Cable Requirements



UV resistance of the connection cable

Connection cables to be laid outdoors must be UV-resistant or routed in a UV-resistant cable channel.

Connection	Cable requirements
Earthing	<input type="checkbox"/> Conductor cross-section: 2.5 mm ² <input type="checkbox"/> Maximum cable length: 30 cm
Voltage supply	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Cable cross-section: 0.2 mm ² ... 2.5 mm ² <input type="checkbox"/> Maximum cable length: 3 m
Digital inputs	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Cable cross-section: 0.2 mm ² ... 1.5 mm ² <input type="checkbox"/> Maximum cable length: 30 m
Digital outputs	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Cable cross-section: 0.2 mm ² ... 1.5 mm ² <input type="checkbox"/> Maximum cable length: 30 m
Analogue inputs, analogue outputs and temperature inputs (single core)	<input type="checkbox"/> Conductor cross-section: 1.5 mm ² <input type="checkbox"/> Length of cable: 32 cm
Analogue inputs (connection cable)	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Shielding: yes <input type="checkbox"/> Cable cross-section: 0.2 mm ² ... 1.5 mm ² <input type="checkbox"/> Maximum cable length: 30 m
Analogue outputs (connection cable)	<input type="checkbox"/> Number of insulated wires: at least two <input type="checkbox"/> Shielding: yes <input type="checkbox"/> Cable cross-section: 0.2 mm ² ... 1.5 mm ² <input type="checkbox"/> Maximum cable length: 3,000 m
Temperature inputs (connection cable)	<input type="checkbox"/> Number of insulated wires for tolerance $\pm 2^\circ\text{C}$: at least 2 <input type="checkbox"/> Number of insulated wires for tolerance $\pm 0.5^\circ\text{C}$: at least 4 <input type="checkbox"/> Cable cross-section: at least 4 x 0.25 mm ² and at least 4 x AWG 24 <input type="checkbox"/> External cable diameter: 4.5 mm ... 7 mm <input type="checkbox"/> Maximum cable length for four-conductor connection: 20 m <input type="checkbox"/> Maximum cable length for two-conductor connection: 2.5 m

Connection	Cable requirements
Inverter (Speedwire)	<ul style="list-style-type: none"> <input type="checkbox"/> Cable category: from Cat5 <input type="checkbox"/> Cable structure and shielding: S/UTP, SF/UTP (S-FTP*), S/FTP (S-STP*) or SF/FTP <input type="checkbox"/> Maximum cable length between two nodes when using patch cables: 50 m <input type="checkbox"/> Maximum cable length between two nodes when using installation cables: 100 m <input type="checkbox"/> When using self-assembly patch cables: two RJ45 connectors per cable
Local area network (LAN)	<ul style="list-style-type: none"> <input type="checkbox"/> Cable category: from Cat5 <input type="checkbox"/> Cable structure and shielding: S/UTP, SF/UTP (S-FTP*), S/FTP (S-STP*) or SF/FTP <input type="checkbox"/> Maximum cable length between two nodes when using patch cables: 50 m <input type="checkbox"/> Maximum cable length between two nodes when using installation cables: 100 m <input type="checkbox"/> When using self-assembly patch cables: two RJ45 connectors per cable

* Designation according to an older standard

6.4 Performing Pin Coding

Pin coding prevents confusion when using multipole terminals, e.g. in the event of removal and later re-insertion of the multipole plug. The correct terminal can always be assigned to the multipole plug via the coded pins. Tip: perform pin coding for all multipole terminals now, even if you do not wish to use all multipole terminals at this point. This means that you do not subsequently have to perform pin coding for the multipole terminals that are not currently in use.

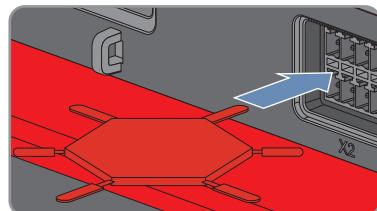


Code the pins correctly

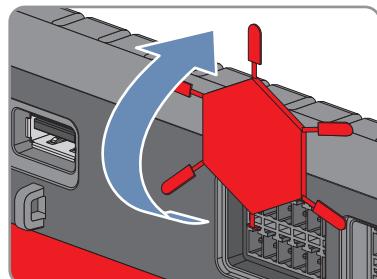
When selecting the pins to be coded, ensure that different pins are coded for each terminal and for each pin row.

Code every multipole terminal according to the following procedure.

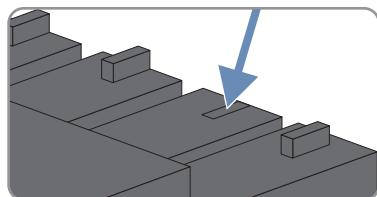
1. Insert the coding tab of the coding element into the pin that is to be coded parallel to the conductor axis.



2. Remove the coding tab from the coding element by snapping it off.



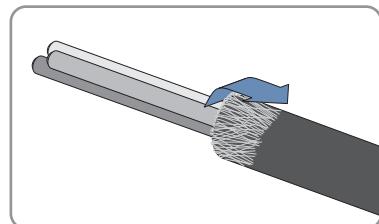
3. Remove the key at the rear of the cable entry in the multipole plug into which the code pin is to be inserted during connection to the Cluster Controller.



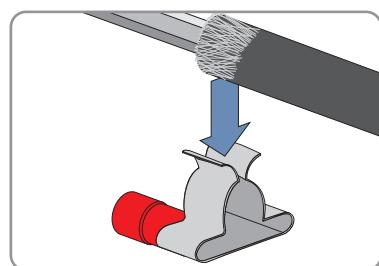
6.5 Preparing Connection Cables for Connection to a Multipole Plug

Always proceed as follows to prepare connection cables for connection to multipole plugs.

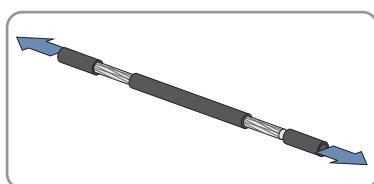
1. Strip 4 cm of cable sheath off the connection cable to which the multipole plug is to be attached.
2. Perform the following additional steps for the connection cables for the analogue inputs, the analogue outputs and the temperature inputs:
 - Trim the cable shield of the connection cable to 15 mm.
 - Fold the surplus cable shield back onto the cable sleeve.



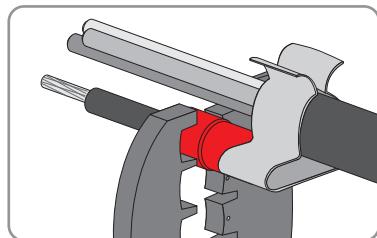
- Press the shield clamp onto the cable shield. For this purpose, the cable shield must be clamped as fully as possible under the shield connection terminal.



- Depending on the number of connection cables, split the single core required for the shielding into pieces of a length of 4 cm.
- At both ends of the single core, remove 6 mm of cable sheath and strip 6 mm insulation off the wire.



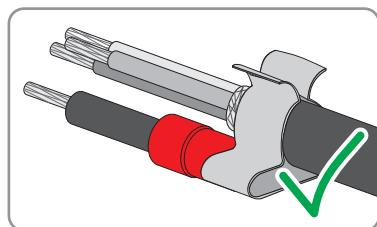
- Insert the insulated wire at one end of the single core into the ring terminal lug of the shield connection terminal and crimp with a crimping tool.



3. Trim unused insulated wires flush with the cable sheath.

4. Strip the insulated wire insulation by 6 mm.

The connection cable is prepared for connection to the multipole plug.



6.6 Connecting the Cluster Controller to a Speedwire Network

Do not connect the Speedwire network and the local network (LAN)

The Speedwire network is a separate network managed by the Cluster Controller. In case the Speedwire network and the local network (LAN) are connected, a disturbance of both networks is likely to occur.

- In order to ensure correct communication, do not connect the Speedwire network and the local network (LAN) (the Speedwire bus and the Ethernet bus must not be connected to the same switch, for example).

Requirements:

- The inverters must be equipped with Speedwire communication (depending on the feature: see the installation manual of the inverter or the installation manual of the Speedwire/Webconnect interface).
- The inverters must be cabled according to one of the possible network topologies (for information on the possible network topologies as well as on the connection of the patch cable to the Speedwire/Webconnect interface, see installation manual of the inverter or installation manual of the Speedwire/Webconnect interface).

Additional required material (not included in scope of delivery):

- Depending on the network topology: patch cables (for cable requirements, see Section 6.3)

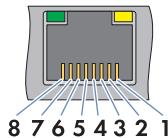


Figure 10: Pin assignment at the network terminals X9, X10, X13 and X14

Pin	Designation	Explanation
1	TX+	Data Out +
2	TX -	Data Out -
3	RX+	Data In +
4	GND	Shield ground
5	GND	Shield ground
6	RX -	Data In -
7	GND	Shield ground
8	GND	Shield ground

1. DANGER

Danger to life due to electric shock when opening the inverter

Lethal voltages are present in the conductive parts of the inverter.

If a patch cable has not yet been connected to the retrofitted Speedwire/Webconnect interface in the inverter, perform the following steps:

- Disconnect the inverter from voltage sources on the AC and DC sides (see the inverter installation manual). Observe the waiting time to allow the capacitors to discharge.
- Open the inverter (see inverter installation manual).
- Connect the patch cable to the retrofitted Speedwire/Webconnect interface (see the installation manual of the Speedwire/Webconnect interface).
- Close the inverter (see inverter installation manual).

2. If no patch cable is connected to the inverter with integrated Speedwire communication and Webconnect function, connect the patch cable to the network socket in the inverter (see installation manual of the inverter).
3. Connect the Cluster Controller to the Speedwire network. For this purpose, observe the desired network topology:
 - When using a pre-configured patch cable, connect the patch cable to terminal **X9** or **X10**.
 - When using a patch cable that is to be configured by the user, mount the RJ45 plug connector on the patch cable (see the manufacturer manual) and connect the patch cable to terminal **X9** or **X10** of the Cluster Controller.
4. On the supplementary sheet for noting the connected devices, note the terminal to which the node is assigned.
5. Deactivate the Webconnect function of the inverters after completion of the commissioning of the Cluster Controllers (see user manual of the Cluster Controller).

6.7 Connecting the Cluster Controller to a Local Area Network (LAN)



Selecting a Suitable Internet Tariff

According to use, the data volume of the Cluster Controller transferred via the Internet can be more than 1 GB per month. The data volume depends, among other things, on the number of inverters, the frequency of device updates, the frequency of data transfer to the Sunny Portal and the use of FTP push.

- SMA Solar Technology AG recommends using an Internet flat rate.

Additional required material (not included in scope of delivery):

- 1 patch cable (for cable requirements, see Section 6.3)

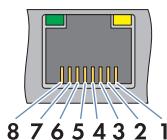


Figure 11: Pin assignment at the network terminals **X9**, **X10**, **X13** and **X14**

Pin	Designation	Explanation
1	TX+	Data Out +
2	TX –	Data Out –
3	RX+	Data In +
4	GND	Shield ground
5	GND	Shield ground
6	RX –	Data In –
7	GND	Shield ground
8	GND	Shield ground

1. Connect the patch cable to the Cluster Controller:
 - When using a pre-configured patch cable, connect the patch cable to terminal **X13** or **X14**.
 - When using a patch cable that is to be configured by the user, mount the two RJ45 plug connectors at both ends of the patch cable (see the manufacturer manual) and connect the patch cable to terminal **X13** or **X14** of the Cluster Controller.
2. Connect the other end of the patch cable to the desired node in the local area network (LAN).
3. On the supplementary sheet for noting the connected devices, note the terminal to which the node is assigned.

6.8 Setting Up a Modbus Data Connection

Additional required accessories (not included in scope of delivery):

- Up to two Modbus clients

Requirements:

- The Cluster Controller and the Modbus client must be located on the same local area network (LAN) (for information on connecting the Cluster Controller to the local area network (LAN), see Section 6.7).
- The commissioning of the Cluster Controller must be completed.

Perform the setup of the Modbus data connection via the user interface of the Cluster Controller (see the Cluster Controller user manual) and the Modbus client (see the manufacturer manual). You can find further information on possible Modbus settings on the Cluster Controller in the technical description "SMA CLUSTER CONTROLLER Modbus® Interface".

6.9 Connecting USB Data Carriers to the Cluster Controller

In order to save plant data or perform an update, you can connect up to two USB data carriers to the Cluster Controller (for information on updates, see the Cluster Controller user manual).



Not possible to use USB Ethernet hubs

The Cluster Controller does not support any USB Ethernet hubs. You must connect the USB data carrier directly to the desired USB terminal on the Cluster Controller.

Additional required accessories (not included in scope of delivery):

- Up to two USB data carriers, e.g. two USB sticks (see Section 10 "Accessories", page 81)

If you use a USB data carrier other than that provided by SMA Solar Technology AG as an accessory, the USB data carrier must correspond to the requirements stated below.

Requirements for USB data carriers:

- Supported file systems: FAT 16 or FAT 32

Period of Archiving

Depending on the available storage capacity of the USB data carrier and your plant's configuration, the following, approximate periods of archiving for the plant data are possible:

Number of connected inverters	Approximate period of archiving	
	4 GB memory capacity	8 GB memory capacity
5	10 years	20 years
10	5 years	10 years
25	2 years	4 years
50	1 year	2 years
75	9 months	18 months

1. To protect the USB data carrier against loss, attach the USB data carrier to the eyelets located on the underside of the USB plug e.g. using a loop attached to the USB data carrier.
2. Connect the USB data carrier to the desired USB terminal:
 - To export plant data, connect the USB data carrier to the USB terminal **1**.
 - To transmit update files to the Cluster Controller, connect the USB data carrier to USB terminal **2**.
3. If the USB data carrier is permanently inserted into the Cluster Controller, the USB terminal to which the USB data carrier is assigned must be noted down on the supplementary sheet for noting the connected devices.
4. If the USB data carrier is to be removed from the Cluster Controller again, wait until the data carrier status LED () is not flashing anymore..

6.10 Connecting Sensors to the Cluster Controller

6.10.1 Connecting the Irradiation Sensor

You can connect one irradiation sensor or pyranometer to the Cluster Controller. The measured value of the irradiation sensor or the pyranometer is shown on the display and the user interface of the Cluster Controller and transmitted to Sunny Portal. In Sunny Portal, the measured values are taken into account in the calculation of the performance ratio.

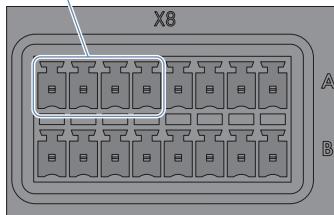
Additional required accessories (not included in scope of delivery):

- 1 irradiation sensor
- 1 connection cable (for cable requirements, see Section 6.3).

Requirements:

- The sensor must be able to output a current signal in the range from 0 mA to 20 mA.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

Analogue current input 1 (AI1)



A1 A2 A3 A4

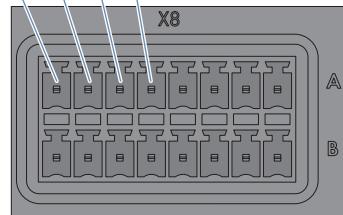


Figure 12: Pin assignment at the terminal block **Analogue current input 1 (AI1)**

Pin	Signal	Explanation
A1	Not assigned	Reserved for future applications
A2	I+	Current input
A3	I -	Current feedback
A4	GND	Shield ground

1. Connect the connection cable to the irradiation sensor (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the eight-pole plug as follows:
 - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.

3. Insert the eight-pole plug at terminal **X8** into pin row **A**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the sensor is assigned.
6. Adjust the characteristic curve of the irradiation sensor or pyranometer via the user interface of the Cluster Controller (see the Cluster Controller user manual). The measured irradiation values can therefore be shown on the display and the user interface of the Cluster Controller.

6.10.2 Connecting the Temperature Sensor

You can connect 1 outside temperature sensor and 1 module temperature sensor to the Cluster Controller. The measured values of the temperature sensors are shown on the display and the user interface of the Cluster Controller and transmitted to Sunny Portal. In Sunny Portal, the measured values of the module temperature sensor flow into the calculation of the performance ratio.

Connecting the Outside Temperature Sensor

Additional required accessories (not included in scope of delivery):

- 1 outside temperature sensor
- 1 connection cable (for cable requirements, see Section 6.3)

Requirements:

- The sensor must have a PT100 measuring shunt or a PT1000 measuring shunt.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

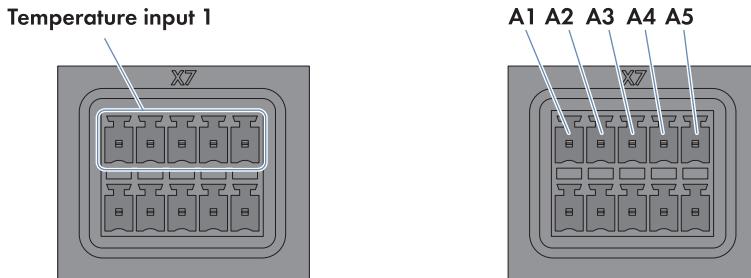


Figure 13: Pin assignment at the terminal block **Temperature input 1**

Pin	Signal	Explanation
A1	GND	Shield ground
A2	I+	Current input
A3	V+	Voltage input
A4	V -	Voltage feedback
A5	I -	Current feedback

1. Connect the connection cable to the outside temperature sensor (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.

2. Connect the connection cable to the five-pole plug as follows:
 - Release conductor entry 1 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - For two-conductor connection, release conductor entries 3 and 4 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
 - For four-conductor connection, release conductor entries 2, 3, 4 and 5 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the five-pole plug at terminal **X7** into pin row **A**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the sensor is assigned.

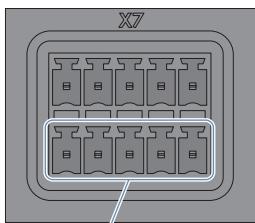
Connecting the Module Temperature Sensor

Additional required accessories (not included in scope of delivery):

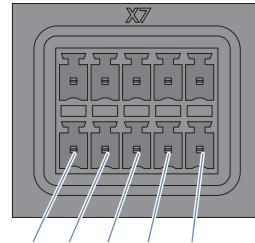
- 1 module temperature sensor
- 1 connection cable (for cable requirements, see Section 6.3)

Requirements:

- The sensor must have a PT100 measuring shunt or a PT1000 measuring shunt.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).



Temperature input 2



B1 B2 B3 B4 B5

Figure 14: Pin assignment at the terminal block **Temperature input 2**

Pin	Signal	Explanation
B1	GND	Shield ground
B2	I+	Current input
B3	V+	Voltage input

Pin	Signal	Explanation
B4	V –	Voltage feedback
B5	I –	Current feedback

1. Connect the connection cable to the module temperature sensor (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the five-pole plug as follows:
 - Release conductor entry 1 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - For two-conductor connection, release conductor entries 3 and 4 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
 - For four-conductor connection, release conductor entries 2, 3, 4 and 5 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the five-pole plug at terminal **X7** into pin row **B**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the sensor is assigned.

6.10.3 Connecting Additional Sensors

Depending on whether you are using an irradiation sensor (see Section 6.10.1), you can connect a maximum of 3 sensors to the analogue current outputs and 1 sensor to the analogue voltage input **X8** of the Cluster Controller.



Display of measured values at terminal block analogue voltage input 4 (AI4)

If no sensor is connected to the terminal block **Analogue voltage input 4 (AI4)**, a measured value for this terminal block of up to 2.2 V will nevertheless be shown on the display and the user interface of the Cluster Controller.

- In order for a measured value of 0 V to be displayed for the terminal block **Analogue voltage input 4 (AI4)** when it is not connected, place a jumper wire at terminal **X8** between pin **B5** and pin **B7**.

Connecting Sensors to the Analogue Current Inputs

Additional required accessories (not included in scope of delivery):

- Up to 3 sensors
- Up to 3 connection cables (for cable requirements, see Section 6.3)

Requirements:

- The sensor must be able to output a current signal in the range from 0 mA to 20 mA.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5)

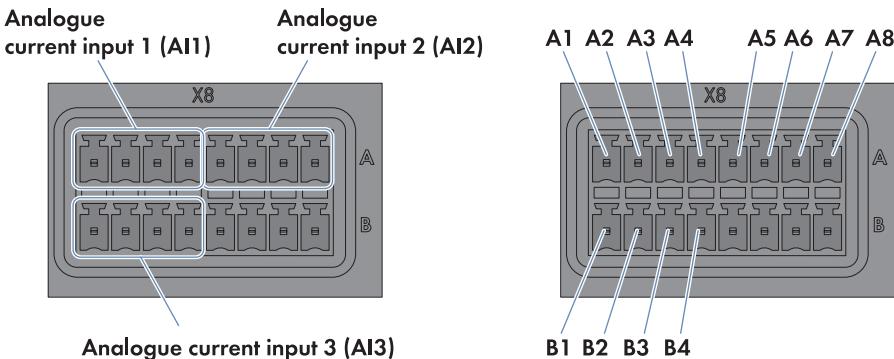


Figure 15: Pin assignment at the terminal blocks **Analogue current input 1 (AI1)**, **Analogue current input 2 (AI2)** and **Analogue current input 3 (AI3)**

Terminal block	Pin	Signal	Explanation
Analogue current input 1 (AI1)	A1	Not assigned	Reserved for future applications
	A2	I+	Current input
	A3	I -	Current feedback
	A4	GND	Shield ground
Analogue current input 2 (AI2)	A5	Not assigned	Reserved for future applications
	A6	I+	Current input
	A7	I -	Current feedback
	A8	GND	Shield ground
Analogue current input 3 (AI3)	B1	Not assigned	Reserved for future applications
	B2	I+	Current input
	B3	I -	Current feedback
	B4	GND	Shield ground

1. Connect the connection cable to the sensor (see the manufacturer manual). For this purpose, trim the insulated wires that are not required up to the cable shield and note the wire colours.

2. For connecting to the terminal block **Analogue current input 1 (AI1)**, perform the following steps:
 - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
 - Insert the eight-pole plug at terminal **X8** into pin row **A**.
3. For connecting to the terminal block **Analogue current input 2 (AI2)**, perform the following steps:
 - Release conductor entry 8 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Release conductor entries 6 and 7 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
 - Insert the eight-pole plug at terminal **X8** into pin row **A**.
4. For connecting to the terminal block **Analogue current input 3 (AI3)**, perform the following steps:
 - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
 - Insert the eight-pole plug at terminal **X8** into pin row **B**.
5. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
6. On the supplementary sheet for noting the connected devices, note the terminal to which the sensor is assigned.

Connecting the Sensor to the Analogue Voltage Input

Additional required accessories (not included in scope of delivery):

- 1 sensor
- 1 connection cable (for cable requirements, see Section 6.3)

Requirements:

- The sensor must be able to output a voltage signal in the range from – 10 V to +10 V.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5)

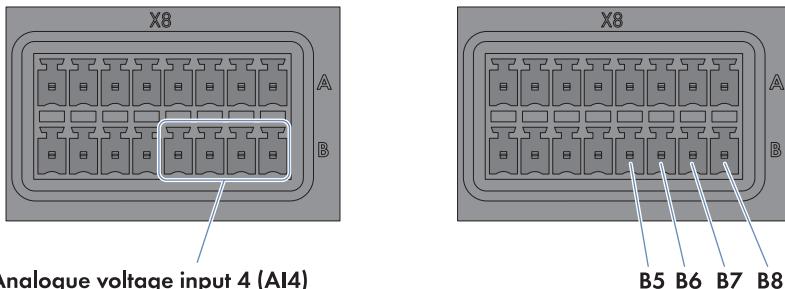


Figure 16: Pin assignment at the terminal block **Analogue voltage input 4 (AI4)**

Pin	Signal	Explanation
B5	V+	Voltage input
B6	Not assigned	Reserved for future applications
B7	V –	Voltage feedback
B8	GND	Shield ground

1. Connect the connection cable to the sensor (see the manufacturer manual). For this purpose, trim the insulated wires that are not required up to the cable shield and note the wire colours.
2. Connect the connection cable to the eight-pole plug as follows:
 - Release conductor entry 8 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Release conductor entries 5 and 7 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the eight-pole plug at terminal **X8** into pin row **B**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the sensor is assigned.

6.11 Connections for Grid Management

6.11.1 Options for Implementing the Network Operator Setpoints

The Cluster Controller can receive the network operator setpoints for grid management via three types of signal. For this purpose, the type of signal can be combined, meaning for example that setpoints for active power limitation can be received as digital signals and the setpoints for the reactive power setpoint can be received as analogue signals.

Configure the grid management via the user interface of the Cluster Controller (see the Cluster Controller user manual).

Type of signal	Explanation
Digital signals	The network operator setpoints are sent to the Cluster Controller as digital signals in the form of binary values. For this purpose, up to four relay contacts can be used for the active power limitation and the reactive power setpoint.
Analogue signals	The network operator setpoints are sent to the Cluster Controller as analogue current signals. For this purpose, current signals from 0 mA to 20 mA can be sent for the active power limitation and the reactive power setpoint, respectively.
Signal via Modbus client	The network operator setpoints are sent to network terminal X13 or X14 of the Cluster Controller via a Modbus client (for information on Modbus configuration, see the Cluster Controller user manual).

6.11.2 Digital Signal Setpoint

6.11.2.1 Connecting the Signal Source to the Digital Input for the Active Power Limitation

The digital signals for the active power limitation can be sent to up to four terminal blocks at terminal **X4** of the Cluster Controller. A ripple control receiver or a remote terminal unit can be used as a digital signal source, for example.

Additional required accessories (not included in scope of delivery):

- Up to four digital signal sources
- Connection cable (for cable requirements, see Section 6.3)

Requirement:

- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

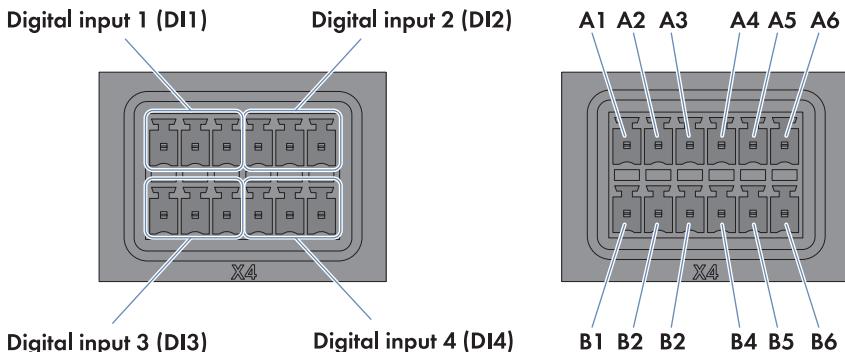


Figure 17: Terminal blocks and pin assignment at terminal **X4**

Terminal block	Pin	Pin assignment	Explanation
Digital input 1 (DI1) Signal 1 of 4 for the active power limitation	A1	24 V	Voltage supply output
	A2	IN	Input
	A3	GND	Reference potential
Digital input 2 (DI2) Signal 2 of 4 for the active power limitation	A4	24 V	Voltage supply output
	A5	IN	Input
	A6	GND	Reference potential

Terminal block	Pin	Pin assignment	Explanation
Digital input 3 (DI3) Signal 3 of 4 for the active power limitation	B1	24 V	Voltage supply output
	B2	IN	Input
	B3	GND	Reference potential
Digital input 4 (DI4) Signal 4 of 4 for the active power limitation	B4	24 V	Voltage supply output
	B5	IN	Input
	B6	GND	Reference potential

1. Connect the connection cable to the digital signal source (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the six-pole plug as follows:
 - Depending on the digital signal source and the pin assignment at terminal **X4**, identify the conductor entries that will be required for connecting the connection cable.
 - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
3. Connect the six-pole plug to terminal **X4**. For this purpose, observe the pin coding.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the digital signal source is assigned.

6.11.2.2 Connecting the Signal Source to the Digital Input for the Reactive Power Setpoint

The digital signals for the reactive power setpoint can be sent to up to four terminal blocks at terminal **X5** of the Cluster Controller. A ripple control receiver or a remote terminal unit can be used as a digital signal source, for example.

Additional required accessories (not included in scope of delivery):

- Up to four digital signal sources
- Connection cable (for cable requirements, see Section 6.3)

Requirement:

- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

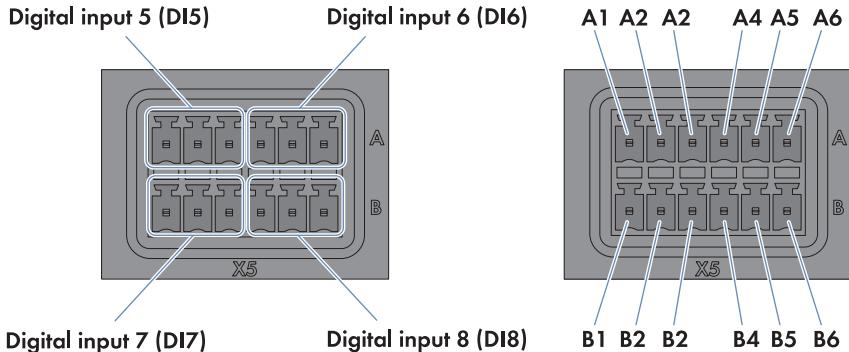


Figure 18: Terminal blocks and pin assignment at terminal **X5**

Terminal block	Pin	Pin assignment	Explanation
Digital input 5 (DI5) Signal 1 of 4 for the reactive power setpoint	A1	24 V	Voltage supply output
	A2	IN	Input
	A3	GND	Reference potential
Digital input 6 (DI6) Signal 2 of 4 for the reactive power setpoint	A4	24 V	Voltage supply output
	A5	IN	Input
	A6	GND	Reference potential
Digital input 7 (DI7) Signal 3 of 4 for the reactive power setpoint	B1	24 V	Voltage supply output
	B2	IN	Input
	B3	GND	Reference potential
Digital input 8 (DI8) Signal 4 of 4 for the reactive power setpoint	B4	24 V	Voltage supply output
	B5	IN	Input
	B6	GND	Reference potential

1. Connect the connection cable to the digital signal source (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the six-pole plug as follows:
 - Depending on the digital signal source and the pin assignment at terminal **X5**, identify the conductor entries that will be required for connecting the connection cable.
 - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
3. Connect the six-pole plug to terminal **X5**. For this purpose, observe the pin coding.

4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the digital signal source is assigned.

6.11.3 Analogue Signal Setpoint

6.11.3.1 Connecting the Signal Source to the Analogue Input for the Active Power Limitation

The analogue signals for the active power limitation are sent to the terminal block **Analogue current input 2 (AI2)** at terminal **X8** of the Cluster Controller. A remote terminal unit can be used as an analogue signal source, for example.

Additional required accessories (not included in scope of delivery):

- 1 analogue signal source
- Connection cable (for cable requirements, see Section 6.3)

Requirements:

- The analogue signal source must be able to output a current signal in the range from 0 mA to 20 mA.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

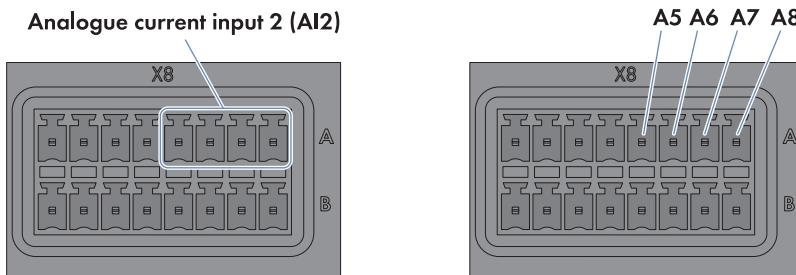


Figure 19: Pin assignment at the terminal block **Analogue current input 2 (AI2)**

Pin	Signal	Explanation
A5	Not assigned	Reserved for future applications
A6	I+	Current input
A7	I -	Current feedback
A8	GND	Shield ground

1. Connect the connection cable to the analogue signal source (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the eight-pole plug as follows:
 - Release conductor entry 8 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Release conductor entries 6 and 7 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.
3. Insert the eight-pole plug at terminal **X8** into pin row **A**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the analogue signal source is assigned.

6.11.3.2 Connecting the Signal Source to the Analogue Input for the Reactive Power Setpoint

The analogue signals for the reactive power setpoint are sent to the terminal block **Analogue current input 3 (AI3)** at terminal **X8** of the Cluster Controller. A remote terminal unit can be used as an analogue signal source, for example.

Additional required accessories (not included in scope of delivery):

- 1 analogue signal source
- Connection cable (for cable requirements, see Section 6.3)

Requirement:

- The analogue signal source must be able to output a current signal in the range from 0 mA to 20 mA.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

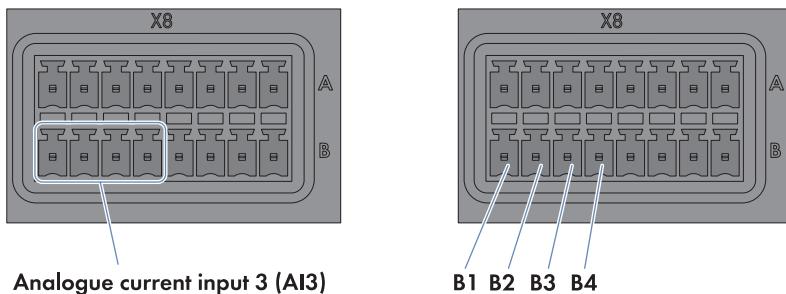


Figure 20: Pin assignment at the terminal block **Analogue current input 3 (AI3)**

Pin	Signal	Explanation
B1	Not assigned	Reserved for future applications
B2	I+	Current input
B3	I -	Current feedback
B4	GND	Shield ground

1. Connect the connection cable to the analogue signal source (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours
2. Connect the connection cable to the eight-pole plug as follows:
 - Release conductor entry 4 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Release conductor entries 2 and 3 using a screwdriver and insert the insulated wires of the connection cable into the conductor entries. Observe the pin assignment.

3. Insert the eight-pole plug at terminal **X8** into pin row **B**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the analogue signal source is assigned.

6.11.4 Setpoint via Modbus Client

Requirements:

- The Cluster Controller and the Modbus client must be located on the same local area network (LAN) (see Section 6.8).
- The commissioning of the Cluster Controller must be completed.

In order to receive the network operator setpoints via a Modbus client, you must perform the Modbus configuration via the user interface of the Cluster Controller after completing the commissioning (see the Cluster Controller user manual).

6.11.5 Connecting the Remote Terminal for Feedback of Network Operator Setpoints

If the Cluster Controller sends the network operator setpoints for grid management to the inverters in the plant, you have the option of providing related feedback to the network operator. For this purpose, the Cluster Controller prepares one digital output and two analogue current outputs as response contacts to which you can connect corresponding remote terminals, e.g. a remote terminal unit.

Connecting the Remote Terminal to the Digital Output

Via the terminal block **Digital output 3 (DO3)**, you can provide feedback on whether the Cluster Controller has sent a network operator setpoint for the active power limitation to the inverters in the plant.

i **Observe the maximum load capacity of the relay contacts**

The relay contacts may be loaded with a maximum switching capacity of 30 watts and a maximum voltage of 48 V DC (see Section 9 "Technical Data", page 77).

Requirement:

- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

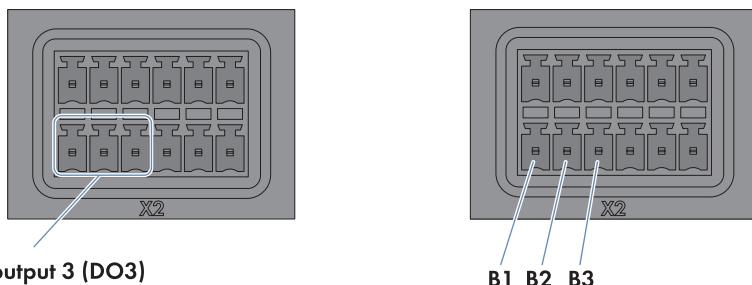


Figure 21: Pin assignment at the terminal block **Temperature output 3 (DO3)**

Terminal block	Relay	Pin	Signal	Explanation
Digital output 3 (DO3)	C	B1	NC	Back contact
Response contact for the current active power limitation		B2	CO	Change-over contact
		B3	NO	Front contact

1. Connect the connection cable to the remote terminal (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. Connect the connection cable to the six-pole plug as follows:
 - Depending on the remote terminal and the pin assignment at terminal block **Digital output 3 (DO3)**, identify the conductor entries that will be required for connecting the connection cable.
 - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
3. Insert the six-pole plug at terminal **X2** into pin row **B**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the remote terminal is assigned.

Connecting the Remote Terminal to the Analogue Current Output

Via the two analogue current outputs **Analogue current output 1 (AO1)** and **Analogue current output 2 (AO2)**, you can provide feedback on the value (if any) for the active power limitation or the reactive power setpoint of the Cluster Controller that is currently being sent to the inverters in the plant.

Requirements:

- The remote terminal must be able to receive a current signal in the range from 4 mA to 20 mA.
- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

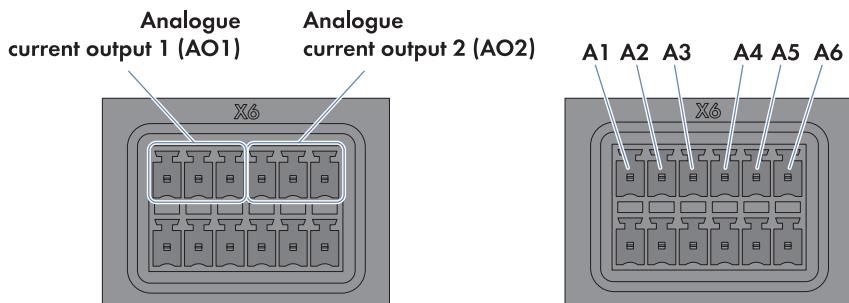


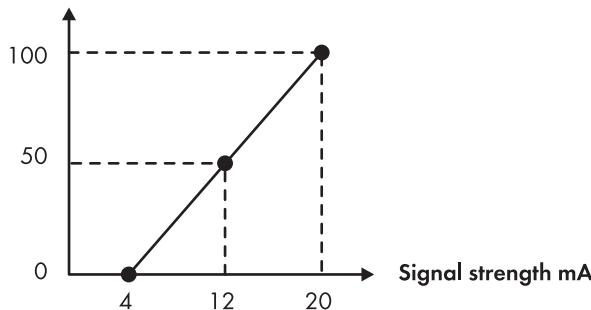
Figure 22: Pin assignment at the terminal blocks **Analogue current output 1 (AO1)** and **Analogue current output 2 (AO2)**

Terminal block	Pin	Signal	Explanation
Analogue current output 1 (AO1)	A1	I+	Current output
	A2	I -	Current feedback
	A3	GND	Shield ground
Analogue current output 2 (AO2)	A4	I+	Current output
	A5	I -	Current feedback
	A6	GND	Shield ground

Interpretation of the Signal Strength as a Percentage Value of the Active Power Limitation

The strength of the feedback signal corresponds to the percentage value to which the active power of the inverters in the plant is currently limited.

Active power limitation in percent (%)*



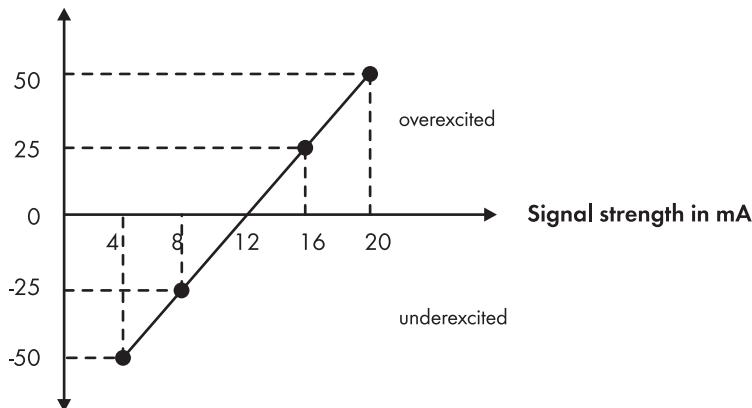
* regarding inverter parameter currently set active power limit or **Pmax**

Figure 23: Interpretation of the signal strength as a percentage value of the active power limitation in relation to the inverter parameter **Set active power limit** or **Pmax**

Interpretation of the Signal Strength as a Vale of the Reactive Power Setpoint

Depending on the size of the reactive power setpoint that was selected via the user interface (see the Cluster Controller user manual), the strength of the feedback signal corresponds either to the percentage value for the reactive power setpoint or to the latest displacement power factor $\cos \varphi$ sent to the inverters in the plant.

Reactive power setpoint in percent (%)^{*}



* regarding inverter parameter currently set active power limit or Pmax

Figure 24: Interpretation of the signal strength as a percentage value of the reactive power setpoint in relation to the inverter parameter **Set active power limit or Pmax**

Reactive power setpoint as displacement power factor $\cos \varphi$

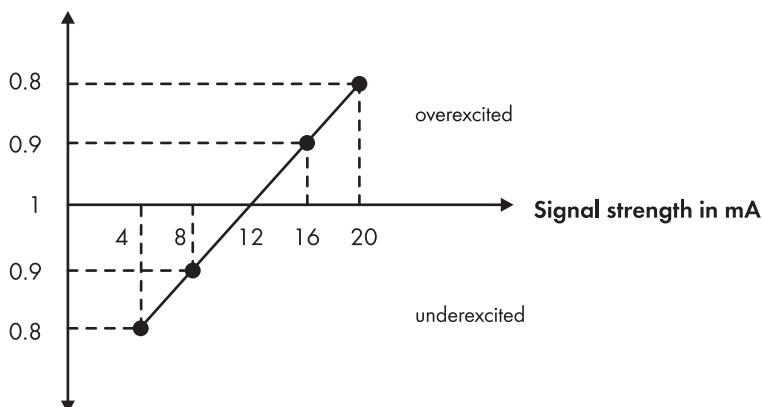


Figure 25: Interpretation of the signal strength as displacement power factor $\cos \varphi$

1. Connect the connection cable to the remote terminal (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.
2. When using the terminal block **Analogue current output 1 (AO1)**, perform the following steps to connect the connection cable to the six-pole plug:
 - Release conductor entry 3 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Depending on the remote terminal and the pin assignment at the terminal block **Analogue current output 1 (AO1)**, identify the conductor entries that are required for the connection of the connection cable.
 - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
3. When using the terminal block **Analogue current output 2 (AO2)**, perform the following steps to connect the connection cable to the six-pole plug:
 - Release conductor entry 6 using a screwdriver and insert the insulated wire of the single core into the conductor entry.
 - Depending on the remote terminal and the pin assignment at the terminal block **Analogue current output 2 (AO2)**, identify the conductor entries that are required for the connection of the connection cable.
 - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
4. Insert the six-pole plug at terminal **X6** into pin row **A**.
5. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
6. On the supplementary sheet for noting the connected devices, note the terminal to which the remote terminal is assigned.

6.12 Using Fault Indication Relays

You can connect up to three remote terminals (e.g. optical or acoustic signal generators) to the three potential-free relay contacts of the Cluster Controller. The relay contacts are implemented as two fault indication relays and one response contact. Via the fault indication relay **Digital output 1 (DO1)**, you can signal the plant status **Fault**. Via the fault indication relay **Digital output 2 (DO2)**, you can signal the plant status **Fault** or **Warning**.



Observe the maximum load capacity of the relay contacts

The relay contacts may be loaded with a maximum switching capacity of 30 watts and a maximum voltage of 48 V DC (see Section 9 "Technical Data", page 77).

Requirement:

- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5).

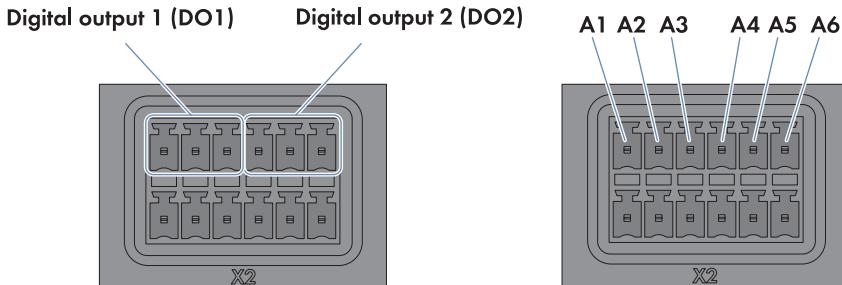


Figure 26: Pin assignment at the terminal blocks **Digital output 1 (DO1)** and **Digital output 2 (DO2)**

Terminal block	Relay	Pin	Signal	Explanation
Digital output 1 (DO1) Fault indication relay for the plant status Fault	A	A1	NC	Back contact
		A2	CO	Change-over contact
		A3	NO	Front contact
Digital output 2 (DO2) Fault indication relay for the plant status Fault or Warning	B	A4	NC	Back contact
		A5	CO	Change-over contact
		A6	NO	Front contact

1. Connect the connection cable to the remote terminal (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.

2. Connect the connection cable to the six-pole plug as follows:
 - Depending on the remote terminal and the pin assignment at the terminal blocks **Digital output 1 (DO1)** and **Digital output 2 (DO2)**, identify the conductor entries that are required for the connection of the connection cable.
 - Release the required conductor entries using a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
3. Insert the six-pole plug at terminal **X2** into pin row **A**.
4. On the connection cable, mark the terminal and pin row to which the connection cable is assigned. For this purpose, use the cable ties with the caption field.
5. On the supplementary sheet for noting the connected devices, note the terminal to which the remote terminal is assigned.

6.13 Connecting the Cluster Controller to the Voltage Supply

DANGER

Danger to life due to electric shock if earthing is omitted

If the enclosure of the Cluster Controller is not earthed, there is a danger of electric shock.

- Earth the enclosure of the Cluster Controller.

NOTICE

Damage to the Cluster Controller due to condensation water

If the Cluster Controller is moved from a cold environment to a warm environment, condensation water may form in the Cluster Controller.

- In the event of large temperature differences, only supply voltage to the Cluster Controller once the Cluster Controller has reached room temperature.

Procedure:

To connect the Cluster Controller to the voltage supply, perform the following actions in the specified order. The following steps show the exact procedure.

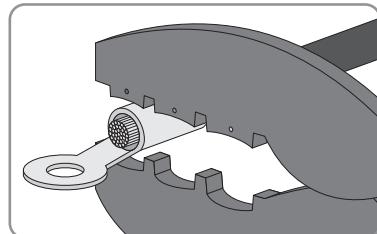
- Connect the protective conductor to the Cluster Controller.
- Connect the top-hat rail power supply unit.

Connecting the Protective Conductor to the Cluster Controller

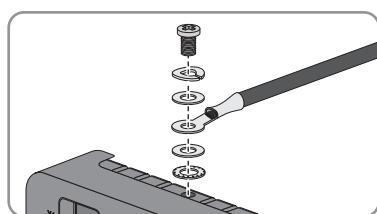
Additional required material (not included in scope of delivery):

- 1 protective conductor (for cable requirements, see Section 6.3)

1. Remove 1 cm of the cable sheath from the protective conductor.
2. Insert the insulated wires into the ring terminal lug and crimp with a crimping tool.



3. Attach the protective conductor at the terminal for the earthing (for the position of the terminal, see Section 6.1). For this purpose, observe the following sequence and hand-tighten the fastening screws (torque: 0.8 Nm):
 - Fastening screw
 - Split lock washer
 - Washer
 - Ring terminal lug with protective conductor
 - Washer
 - Tooth lock washer



Connecting the Top-Hat Rail Power Supply Unit

Additional required material (not included in scope of delivery):

- 1 top-hat rail power supply unit (see Section 10 "Accessories", page 81)
- 1 AC connection cable
- 1 connection cable for the connection of the top-hat rail power supply unit to the Cluster Controller (for cable requirements, see Section 6.3)

If you are not using the top-hat rail power supply unit supplied as an accessory for the Cluster Controller, the top-hat rail power supply unit you are using must meet the requirements detailed below.

Top-hat rail power supply unit requirements:

- Maximum output current including short circuit: 8 A
- Maximum apparent output power: 100 VA
- DC output voltage: 24 V
- Nominal current: minimum 1.8 A

Requirement:

- The connection cable must have been prepared for connection to the multipole plug (see Section 6.5)

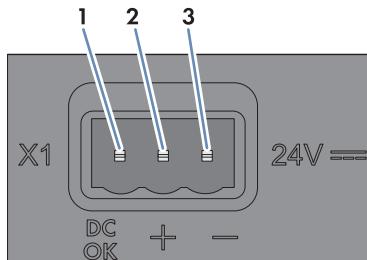


Figure 27: Pin assignment at terminal X1

Pin	Signal	Explanation
1	Not assigned	Reserved for future applications
2	24 V	Input voltage 24 V DC
3	GND	Ground

1. Mount the top-hat rail power supply unit on the top-hat rail (see the manufacturer manual).
2. Connect the connection cable to the top-hat rail power supply unit (see the manufacturer manual). For this purpose, trim the unused insulated wires up to the cable shield and note the wire colours.

3. Connect the connection cable to the three-pole plug as follows. For this purpose, release conductor entries 2 and 3 with a screwdriver and insert the insulated wires into the conductor entries. Observe the pin assignment.
4. Connect the three-pole plug to terminal **X1** of the Cluster Controller.
5. Connect the AC connection cable to the top-hat rail power supply unit (see the manufacturer manual).

6. DANGER

Danger to life due to electric shock

Lethal voltages are present at the connection point of the electricity grid.

- Disconnect the connection point from the electricity grid using the separator (e.g. miniature circuit-breaker).

7. Connect the other end of the AC connection cable to the electricity supply.
8. Connect the connection point to the electricity grid.

The power LED () of the Cluster Controller glows red for two seconds, then it permanently glows green. The status LED () glows corresponding to the current device status (see Section 7.1 "LED States", page 65). The Cluster Controller is ready for operation after a maximum of one minute.

Is the power LED () glowing permanently red, the status LED () glowing yellow or red and the Cluster Controller not starting?

Possible fault cause: the voltage supply is too low.

- Ensure that the voltage supply is sufficient (see Section 9 "Technical Data", page 77).
- If the problem persists, contact the SMA Service Line (see Section 11).

6.14 Checking the Connections via the Display

You can use the display of the Cluster Controller to check whether the connections have been made correctly and whether all inverters, sensors and remote terminals have been detected by the Cluster Controller.

Available display languages

The display languages of the Cluster Controller are German and English. The default language is English.

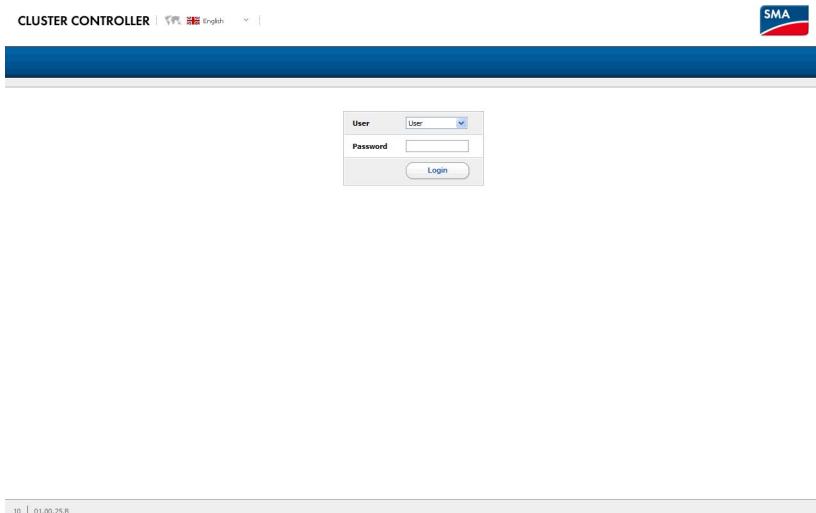
Procedure:

- The display language can be changed via the user interface of the Cluster Controller if required.
- Check the connections via the display.

Changing the Display Languages via the User Interface of the Cluster Controller

You can only change the display language via the user interface of the Cluster Controller

1. Read out and write down the IP address of the Cluster Controller.
 - Select the **External communication** display view.
 - Read out the IP address from the **IP Address** line and write it down. Tip: if you wish to integrate the Cluster Controller in a static local area network (LAN), you also require the IP address for the network configuration (see Section 6.15).
2. Call up the IP address via the Internet browser.
 The login page opens.



Does the login page fail to open?

Possible fault cause: you have not written down the IP address correctly or you have not entered it correctly.

- Enter the correct IP address and confirm the entry with the Enter button.
- If the problem persists, read the troubleshooting (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 70).

3. Select the desired language in the upper area of the login page.
4. Log in either as **User** or as **Installer** with the respective default plant password of the user group. This implements the language change on the user interface and on the display:

User group	Default plant password
User	0000
Installer	1111



Changing default plant passwords

Change the default plant passwords of all user groups promptly to prevent unauthorised access to the user interface of the Cluster Controller and the inverters in your plant (see the Cluster Controller user manual).

- The user interface opens. The display language and the user interface language are changed.

- Does the user interface fail to open?

Fault cause: you have not entered the default plant password of the selected user group correctly.

- On the login page, enter the correct default plant password for the selected user group and confirm the entry with the Enter button.

5. Select **[Logout]** in the icon bar.

Checking the Connections via the Display

The content of the display views takes one or two seconds to update. For technical reasons, representation on the display depends on the ambient temperature and may be correspondingly delayed in the event of low ambient temperature.

1. Select the **Plant status** display view.
2. Check whether the correct total number of connected inverters is displayed in the **Number of devices** line.

Plant Status		10:01
Number of devices	42	
Device status: ok	40	
Device status: warning	1	
Device status: error	1	

If the correct total number of connected inverters is not displayed, it is likely that one or more inverters are not connected correctly (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 70).

3. When using the digital inputs, select the **Digital Inputs** display view.
4. Check whether the expected binary values are displayed in the lines **Dig. input group 1** and **Dig. input group 2**.

Digital inputs		10:03
Dig. input group 1	0 0 0 1	
Dig. input group 1	0 0 0 0	

If the expected binary values are not displayed, it is likely that the digital signal source is not correctly connected (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 70).

5. When using the analogue inputs, select the **Analogue inputs** display view.

6. If an analogue signal source or a sensor is connected, check whether a current signal is displayed in the lines **Ana. current input 1 (AI1)**, **Ana. current input 2 (AI2)** or **Ana. current input 3 (AI3)**, respectively.

If no current signal is displayed, it is likely that the analogue signal source or the sensor is not correctly connected (see Section 7.2 "Faults in the Cluster Controller or the Connected Devices", page 70).

7. If a sensor is connected to the terminal block **Analogue voltage input 4 (AI4)**, check whether a measured value is displayed in the line **Ana. voltage input 4**.

Analogue inputs		10:02
Ana. current input 1	8.35 mA	
Ana. current input 2	0.00 mA	
Ana. current input 3	14.00 mA	
Ana. voltage input 4	8.50 V	

Analogue inputs		10:02
Ana. current input 1	8.35 mA	
Ana. current input 2	0.00 mA	
Ana. current input 3	14.00 mA	
Ana. voltage input 4	8.50 V	

If no measured value is displayed, the sensor is not correctly connected.

- Ensure that the sensor is correctly connected (see Section 6.10.3).

8. When connecting an irradiation sensor or a temperature sensor, select the **Meteorology** display view.
 9. Check whether measured values are displayed for each connected sensor.

Meteorology		10:33
Ambient temperature	25.5 °C	
Module temperature	40.0 °C	
Insolation	852 W/m ²	

If no measured values are displayed for the connected temperature sensor, the temperature sensor is not correctly connected.

- Ensure that the temperature sensor is correctly connected (see Section 6.10.2).

If no measured values are displayed for the irradiation sensor, either the characteristic curve of the irradiation sensor is not configured or the irradiation sensor is not correctly connected.

- Ensure that the characteristic curve of the irradiation sensor is configured (see the Cluster Controller user manual).
- Ensure that the irradiation sensor is correctly connected (see Section 6.10.1).

6.15 Performing Configuration for a Static Local Network (LAN)

You have the option of configuring the Cluster Controller and the inverters in the plant for a static local area network (LAN) (see the Cluster Controller user manual). The Cluster Controller and the inverters are configured for automatic address allocation via DHCP by default.

7 Troubleshooting

7.1 LED States

7.1.1 Operation LEDs

Configuration of the status LED ()

The status LED can display the following statuses:

- Status of the Cluster Controller
- Status of the connected inverters
- Status of the plant communication
- Status of the grid management

In this document, the only states described below are those that the status LED can adopt upon initial start-up (for a complete description of the states, see the Cluster Controller user manual).

- If the status LED is not glowing green after commissioning, refer also to the event log of the Cluster Controller to determine the precise cause of the fault. The details of the respective fault are logged in the event log (see the Cluster Controller user manual).

LED	Status	Cause and corrective measures
All	Off	<p>The Cluster Controller is not connected to the voltage supply.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Connect the Cluster Controller to the voltage supply (see Section 6.13).
		<p>The voltage supply is reverse-connected or the top-hat rail power supply unit is defective.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the voltage supply is correctly connected (see Section 6.13). • If the voltage supply is correctly connected, replace the top-hat rail power supply unit.
Power () and status ()	Power glowing red, status glowing yellow or red	<p>The voltage supply is too low.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the connected voltage supply is sufficient (see Section 6.13). • If the problem persists, contact the SMA Service Line (see Section 11).
Power	Glowing green	The start procedure is complete. The Cluster Controller is ready for operation.

LED	Status	Cause and corrective measures
Status ()	Glowing green	Normal operation
	Glowing yellow	<p>At least one device has the status Warning.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Observe the event log of the Cluster Controller (see the Cluster Controller user manual). • Observe the device documentation.
	Glowing red	<p>At least one device has the status Fault.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Observe the event log of the Cluster Controller (see the Cluster Controller user manual). • Observe the device documentation.
	Flashing red	<p>The SD card in the Cluster Controller may be defective.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the event report of the Cluster Controller (see the Cluster Controller user manual). • If the SD card is defective, contact the SMA Service Line (see Section 11).

LED	Status	Cause and corrective measures
Data carrier status ()	Off	<p>The Cluster Controller is starting and no information is yet available for data export or for USB data carriers.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Wait until the Cluster Controller has completed the start process and is ready for operation. Once the start process is complete, the power LED () glows green.
		<p>No USB data carrier was detected. It is possible that no USB data carrier is connected or the USB data carrier is not compatible.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Ensure that a compatible USB data carrier is connected (see Section 9 "Technical Data", page 77).
Glowing green		<p>The USB data carrier is compatible. The free memory capacity is above 10%.</p>
Flashing green		<p>The USB data carrier is compatible. The free memory capacity is above 10% and write or read accesses are currently being performed.</p> <ul style="list-style-type: none"> Only remove the USB data carrier once the data carrier status LED is not flashing anymore..
Glowing yellow		<p>The USB data carrier at the USB terminal 1 is compatible but the free memory capacity is 10% at maximum.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Files that are no longer required are to be deleted from the USB data carrier. or Replace the USB data carrier with a USB data carrier that has sufficient free memory capacity.

LED	Status	Cause and corrective measures
Data carrier status ()	Flashing yellow	<p>The USB data carrier at the USB terminal 1 is compatible, but the free memory capacity is 10% at maximum and write or read accesses are currently being performed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Wait until the Cluster Controller has completed the write or read access and the data carrier status LED glows yellow. • Replace the USB data carrier with a USB data carrier that has sufficient free memory capacity.
	Glowing red	<p>The USB data carrier at USB terminal 1 is full or write-protected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • If the USB data carrier is full, replace the USB data carrier. • If the USB data carrier is write-protected, remove the write protection or use a USB data carrier without write protection.
	Flashing red	<p>The USB data carrier at USB terminal 1 is full or write-protected and write or read accesses on the USB terminal 2 are currently being performed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • If the USB data carrier is full, delete files that are no longer required or replace the USB data carrier. • If the USB data carrier is write-protected, remove the write protection or use a USB data carrier without write protection.

7.1.2 LEDs of the Network Connections

LED	Status	Cause and corrective measures
Link/Activity (green)	Off	<p>No network connection has been established. The Cluster Controller is not connected to the voltage supply.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Connect the Cluster Controller to the voltage supply (see Section 6.13).
		<p>No network connection has been established. The patch cable at the Cluster Controller, at the router or at the network switch is not correctly connected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the patch cable is correctly connected (see Section 6.7).
	Flashing	<p>No network connection has been established. One or more network components, patch cables or plug connectors are defective or damaged.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Replace the defective or damaged network components, patch cables or plug connectors.
		<p>Network connection established. Data is being transmitted or received.</p>
Speed (yellow)	Off	<p>Network connection established. The data transfer speed is 10 Mbit/s.</p>
	On	<p>Network connection established. The data transfer speed is 100 Mbit/s.</p>

7.2 Faults in the Cluster Controller or the Connected Devices

Problem	Cause and corrective measures
The Cluster Controller does not start. The LEDs and the display are off.	<p>The Cluster Controller is not connected to the voltage supply.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the three-pole plug for the voltage supply is connected to terminal X1 of the Cluster Controller. <p>The voltage supply is reverse-connected or the top-hat rail power supply unit is defective.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the voltage supply is correctly connected (see Section 6.13). • If the voltage supply is correctly connected, replace the top-hat rail power supply unit.
The login page does not open and the status LED () flashes red.	<p>The Cluster Controller could not start correctly. A system fault has occurred.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Disconnect the Cluster Controller from the voltage supply and reconnect to the voltage supply. Note that this can lead to loss of plant data. • If the problem persists, contact the SMA Service Line (see Section 11).

Problem	Cause and corrective measures
The login page does not open.	<p>The Cluster Controller is not connected to the voltage supply.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the three-pole plug for the voltage supply is connected to terminal X1 of the Cluster Controller.
	<p>The voltage supply is reverse-connected or the top-hat rail power supply unit is defective.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the voltage supply is correctly connected (see Section 6.13). • If the voltage supply is correctly connected, replace the top-hat rail power supply unit.
	<p>A firewall is blocking the connection.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Adjust the firewall settings in order to allow the required connection.
	<p>If the Cluster Controller is connected to the local area network (LAN) via DHCP and the voltage supply of the Cluster Controller was interrupted, it is possible that the DHCP server in the local area network (LAN) has assigned a new IP address to the Cluster Controller.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Select the External communication display view and read out the current IP address of the Cluster Controller. • Call up the IP address via the Internet browser.

Problem	Cause and corrective measures
The login page does not open.	<p>There is a problem in the local area network (LAN).</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the patch cable is correctly connected to the Cluster Controller (see Section 6.7). • Check whether the network components, patch cables or plug connectors are defective or damaged. Replace defective or damaged network components, patch cables or plug connectors. • Check whether the network settings of the individual network components are correct. Adapt the network settings if required. • Restart the Cluster Controller. For this purpose, disconnect the Cluster Controller from the voltage supply and reconnect to the voltage supply. Note that this can lead to loss of plant data. • If the problem persists, contact the network administrator.
Login to the user interface has failed.	<p>The plant password has been entered incorrectly four times. Access to the Cluster Controller is suspended for 15 minutes.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Wait for 15 minutes, then log in with the correct plant password.
The user interface is not displayed properly.	<p>JavaScript is disabled in the Internet browser.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Enable JavaScript in the Internet browser.

Problem	Cause and corrective measures
The correct number of all connected inverters is not shown on the display.	<p>The communication with at least one inverter is interrupted. Either the Cluster Controller has not yet registered with one or more inverters or the connection to one or more inverters has been interrupted.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Wait for six minutes and re-check whether the correct number of all connected inverters is displayed. <p>If the correct number of all connected inverters is still not displayed:</p> <ul style="list-style-type: none"> Ensure that the inverters are in operation. Ensure that the patch cables that connect the inverters to one another are correctly connected (depending on the feature: see the installation manual of the inverter or the installation manual of the Speedwire/Webconnect interface). Ensure that the inverter patch cable that is directly connected to the Cluster Controller is connected to network terminal X9 or X10 of the Cluster Controller. Ensure that no network components, patch cables or plug connectors are defective.
The expected binary values for the digital signal source are not shown on the display.	<p>The digital signal source is not correctly connected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Ensure that the digital signal source is correctly connected (see Section 6.11.2).
No current signal for the analogue signal source or the sensor is shown on the display.	<p>It is likely that the analogue signal source or the sensor is not correctly connected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Ensure that the analogue signal source is correctly connected (see Section 6.11.3). Ensure that the sensor is correctly connected (see Section 6.10.3).
No measured values for the connected temperature sensor are shown on the display.	<p>The temperature sensor is not correctly connected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Ensure that the temperature sensor is correctly connected (see Section 6.10.2).

Problem	Cause and corrective measures
No measured values for the connected irradiation sensor are shown on the display.	<p>If no measured values are displayed for the irradiation sensor, either the characteristic curve of the irradiation sensor is not configured or the irradiation sensor is not correctly connected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the characteristic curve of the irradiation sensor is configured (see the Cluster Controller user manual). • Ensure that the irradiation sensor is correctly connected (see Section 6.10.1).
Despite not being switched on, a measured value of up to 2.2 V for Analogue voltage input 4 (AI4) is still shown on the display and the user interface.	<p>If no sensor is connected to the terminal block Analogue voltage input 4 (AI4), a measured value of up to 2.2 V will nevertheless be shown in the display and on the user interface of the Cluster Controller.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • In order for a measured value of 0 V to be displayed for the terminal block Analogue voltage input 4 (AI4) when it is not connected, place a jumper wire at terminal X8 between pin B5 and pin B7.

7.3 Resetting the Cluster Controller

You can reset the Cluster Controller via the button field.

1. Call up the **Settings** display view. For this purpose, simultaneously press and hold the [**OK**] and [**ESC**] buttons on the button field for two seconds.
 - The **Settings** display view opens.
2. Select the settings that are to be reset:

Settings to be reset	Explanation
Reset password	The user password and the installer password are reset.
Reset Network Settings	The network settings of the Cluster Controller are reset.
Restoring Factory Settings	The Cluster Controller is reset to default settings. Stored plant data is deleted.

3. To exit the display view again, press [**ESC**].
4. To confirm the settings that are to be reset, perform the following steps:
 - Press [**OK**].

The **Confirm the Resetting** display view appears.

- Select **OK** and confirm with [**OK**].

The selected settings are reset.

If the network settings were reset or the Cluster Controller was reset to default settings, the Cluster Controller restarts.

8 Decommissioning

8.1 Disassembling the Cluster Controller

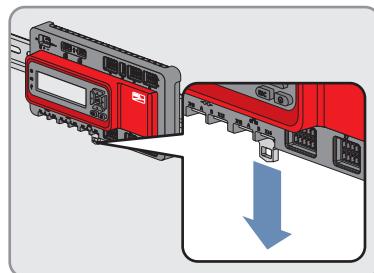
1. DANGER

Danger to life due to electric shock.

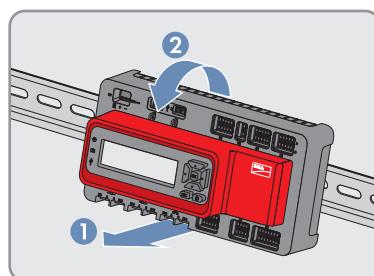
Lethal voltages are present at the connection point of the electricity grid.

- Disconnect the connection point from the electricity grid using the separator (e.g. miniature circuit-breaker).
- Remove the three-pole plug of the top-hat rail power supply unit from terminal **X1** of the Cluster Controller.

2. Remove the patch cable of the Speedwire network (e.g. of the inverter) from the Cluster Controller.
3. Remove the patch cable of the local area network (LAN) (e.g. of the router) from the Cluster Controller.
4. Remove the multipole plugs of the connected devices and sensors from the Cluster Controller.
5. Remove the Cluster Controller from the top-hat rail:
 - Pull or press the visible flap of the top-hat rail locking mechanism located underneath the Cluster Controller downwards using a screwdriver.



- Tilt the lower edge of the Cluster Controller forwards and remove from the top-hat rail.



8.2 Disposing of the Cluster Controller

- Dispose of the Cluster Controller in accordance with the locally applicable disposal regulations for electronic waste.

9 Technical Data

General Data

Status display	LEDs, display
Operation	Button field, integrated Web server
Type of mounting	Top-hat rail mounting
Mounting location	Indoors

Mechanical Data

Width x height x depth	275 mm x 133 mm x 71 mm
Weight	1.2 kg

Display

Display	LCD display
Resolution	240 px x 64 px
Display languages	German, English
Operation	Button field

Memory

Internal ring buffer	1.7 GB
External memory*	USB data carrier

* optional

Voltage supply

Voltage supply	Top-hat rail power supply
Input voltage	18 V DC ... 30 V DC
Typical power consumption	24 W
Maximum power consumption	30 W

Ambient Conditions

Ambient temperature in operation*	– 25°C ... +60°C
Ambient temperature during storage and transport	– 40°C ... +70°C
Relative humidity in operation**	4% ... 95%
Relative humidity during storage and transport**	10% ... 95%
Degree of protection according to IEC 60529	IP20
Electromagnetic compatibility according to EN 55022	Class A
Maximum height above MSL	3,000 m

* If the flow rate of the ambient air is constantly $\geq 0.5 \text{ m/s}$, the ambient temperature range in operation will be extended to – 25°C ... +70°C.

** non-condensing

Communication

Inverter	Speedwire
Local area network (LAN)	Ethernet
Data interfaces	HTTP, FTP, Modbus TCP/UDP, SMTP, Sunny Portal

Maximum Radio Range

Speedwire*	100 m
Ethernet*	100 m

* between two nodes when using installation cables

Maximum Number of Devices

SMA inverter	75
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Network Connections

Number (Speedwire)	2
Number (local area network (LAN))	2
Auto-MDIX (auto-crossing)	Yes
Data transfer standard	10BASE-T or 100BASE-TX
Data transfer rate*	10 Mbit/s or 100 Mbit/s

* negotiated via autonegotiation

Digital Inputs

Quantity	8
Input voltage	24 V DC
Maximum cable length	30 m

Digital Outputs

Quantity	3
Model	Potential-free relay contacts
Maximum switching power	30 W
Maximum voltage load	48 V DC
Maximum cable length	30 m

Analogue Inputs

Number of analogue inputs for current signals	3
Number of analogue inputs for voltage signals	1
Measurement range for current signals	0 mA ... 20 mA
Measuring range for voltage signals	0 V ... +10 V
Typical tolerance	± 0.3%
Maximum tolerance	± 2%
Maximum cable length	30 m

Analogue Outputs

Number of analogue outputs for current signals	2
Measurement range for current signals	4 mA ... 20 mA
Maximum tolerance	± 0.5%
Maximum cable length	3,000 m

Temperature Inputs

Quantity	2
Measuring shunt	Printed circuit board sensor PT100, printed circuit board sensor PT1000
Type of measurement	Two-conductor connection, four-conductor connection
Measuring range	– 40 °C ... +85 °C
Maximum tolerance*	± 0.5 °C
Maximum cable length*	20 m

* for measuring with four-conductor connection

USB Terminals

Quantity	2
Specification	USB 2.0 Hi-Speed
Maximum current	500 mA
Maximum cable length	3 m

10 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, you can order them from SMA Solar Technology AG or from your specialist dealer.

Designation	Brief description	SMA order number
Top-hat rail power supply	Top-hat rail power supply for the SMA Cluster Controller	CLCON-PWRSUPPLY
USB stick 4 GB	USB memory stick with storage capacity of 4 GB	USB-FLASHDRV4GB
USB stick 8 GB	USB memory stick with storage capacity of 8 GB	USB-FLASHDRV8GB

11 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Serial number and firmware version of the Cluster Controller
- Type, serial number and firmware version of the inverter
- When using a retrofitted Speedwire/Webconnect interface: serial number and firmware version of the Speedwire/Webconnect interface

You can read out the necessary information via the user interface of the Cluster Controller (see the Cluster Controller user manual). Alternatively, you can also read out the serial number and the device type on the type label of the respective product (see the respective product manual). You can read out the serial number and the firmware version of the Cluster Controller on the **Cluster Controller** display view.

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